



Potential impact of lava flows on regional water supplies: case study of central Oregon Cascades volcanism and the Willamette Valley, USA

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Lava flows are often considered to be natural hazards with localized bimodal impact – they completely destroy everything in their path, but apart from the occasional forest fire, cause little or no damage outside their immediate footprint. However, in certain settings, lava flows can have surprising far reaching impacts with the potential to cause serious problems in distant urban areas. Here we present results from a study of the interaction between lava flows and surface water in the central Oregon Cascades, USA, where we find that lava flows in the High Cascades have the potential to cause considerable water shortages in Eugene, Oregon (Oregon's second largest metropolitan area) and the greater Willamette Valley (home to ~70% of Oregon's population). The High Cascades host a groundwater dominated hydrological regime with water residence times on the order of years. Due to the steady output of groundwater, rivers sourced in the High Cascades are a critical water resource for Oregon, particularly in August and September when it has not rained for several months. One such river, the McKenzie River, is the sole source of drinking water for Eugene, Oregon, and prior to the installation of dams in the 1960s accounted for ~40% of late summer river flow in the Willamette River in Portland, 445 river km downstream of the source of the McKenzie River. The McKenzie River has been dammed at least twice by lava flows during the Holocene; depending the time of year that these eruptions occurred, we project that available water would have decreased by 20% in present-day Eugene, Oregon, for days to weeks at a time. Given the importance of the McKenzie River and its location on the margin of an active volcanic area, we expect that future volcanic eruptions could likewise impact water supplies in Eugene and the greater Willamette Valley. As such, the urban center of Eugene, Oregon, and also the greater Willamette Valley, is vulnerable to the most benign of volcanic hazards, lava flows, located over 100 km away.